

In the Claims

Claims 7, 8 and 14 have been amended as suggested by the Examiner to overcome the objections to these claims.

Claims 4 to 6, 11 to 13 and 16 to 18 have been amended as suggested by the Examiner to overcome the 35 U.S.C. §112, second paragraph, rejections to these claims.

Claim Objections

The Objection to Claim 7 Because of the Following Informalities: On Line 2, Replace [comprising] with -- consisting of -- so as to Conform to Proper Markush Language

The objection to claim 7 because of the following informalities: on line 2, replace [comprising] with -- consisting of -- so as to conform to proper Markush language is acknowledged.

Claim 7 has been so amended.

The Objection to Claims 8 and 14 Because of the Following Informalities: Delete the Typographical Error/Repeated Phrase [includes at least]

The objection to claims 8 and 14 because of the following informalities: delete the typographical error/repeated phrase [includes at least] is acknowledged.

Claims 8 and 14 have been so amended.

Claim Rejections

The Rejection Of Claims 4 to 6, 11 to 13 and 16 to 18 Under 35 U.S.C. §112, Second Paragraph, as Being Indefinite for Failing to Particularly Point Out and Distinctly Claim the Subject Matter Which Applicant Regards as the Invention

The rejection of claims 4 to 6, 11 to 13 and 16 to 18 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention is acknowledged.

Claims 4 to 6, 11 to 13 and 16 to 18 have been amended as suggested by the Examiner to overcome these 35 U.S.C. §112, second paragraph, rejections.

The Rejection Of Claims 1, 3, 4, 7, 8, 10 and 11 Under 35 U.S.C. §103(a) as Being Unpatentable Over Sasaki et al. (U.S. Patent No. 5,770,095) In View Of Ho (U.S. Patent No. 6,123,088)

The rejection of claims 1, 3, 4, 7, 8, 10 and 11 under 35 U.S.C. §103(a) as being unpatentable over Sasaki et al. (U.S. Patent No. 5,770,095) (the '095 Sasaki Patent) in view of Ho (U.S. Patent No. 6,123,088) (the '088 Ho Patent) is acknowledged.

Applicants' wish to briefly point up the claimed limitations of their invention which are believed to be not shown nor obvious from the teachings of known references in this field. The independent claims all clearly define polishing a metal layer having recessed portions using a slurry including a polishing agent containing: a chemical agent including at least a carbonyl derivative of benzotriazole, the chemical agent forming a protective film on the surface of the metal layer; and an etching agent for etching the metal layer.

The '095 Sasaki Patent describes a CMP metal polishing method using a slurry including a polishing agent containing: a chemical agent including a benzotriazole that forms a protective film on the surface of the metal layer; and an etching agent of H_2O_2 , HF and an amino acid for etching the metal layer.

The '088 Ho Patent describes a method and cleaner composition for stripping copper containing residue layers. In the background of the invention, Ho discloses an article entitled "*Synthesis of Some Carbonyl Derivatives of BTA and Determination of Their Inhibitive Properties for Copper in 3% NaCl Solution*," described as disclosing various *nitrogen substituted* benzotriazole (BTA) with various acid

chlorides. These various nitrogen substituted BTA derivatives exhibit improved corrosion protection for copper surfaces in comparison with the nitrogen unsubstituted BTA parent material from which they are derived.

Independent claims 1 and 8 distinguish over the '095 Sasaki Patent) in view of the '088 Ho Patent under §103(a) because, inter alia:

Ho is from a different field, i.e. stripping copper residues v. polishing copper;

Ho discloses *nitrogen* substituted BTA derivatives and not *carbonyl* BTA derivatives as claimed in the instant invention;

the prior art lack a suggestion that Sasaki should be modified in a manner required to meet the claims;

the Examiner has misunderstood Ho;

the Examiner has made a strained interpretation of the Ho reference that could be made only by hindsight;

Applicant' invention solves a different problem than the Ho reference;

the Examiner has not presented a convincing line of reasoning as to why the claimed subject matter as a whole, including its differences over the prior art, would have been obvious; and

the prior art references do not contain any suggestions (express or implied) that they be combined, or that they be combined in the manner suggested.

Claims 2 to 7 depend from independent claim 1; and claims 9 to 13 depend from independent claim 8; and are believed to distinguish over the

combination for the reasons previously cited. (Remaining claims 14 to 18 as now amended are allowable per the Examiner's remarks - see below)

Allowable subject matter

The objection to claim 14 because of minor informalities and claim 15 as being dependent upon an objected to base claim, i.e. claim 14, is acknowledged.

Claim 14 has been amended to overcome the minor informalities as noted by the Examiner so claims 14 and 15 are now allowable.

The objection to claims 2 and 9 as being dependent upon a rejected base claim, i.e. 1 and 8, respectively, but allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims is acknowledged.

Applicant requests that the rewriting of allowable claims 2 and 9 be held in abeyance pending the final determination of the allowability of the amended parent claims 1 and 8, respectively.

The allowability of claims 5, 6, 12, 13 and 16 to 18 if rewritten to overcome the rejection(s) under 35 U.S.C. §112, second paragraph, set forth in this

Office Action and to include all of the limitations of the respective base claims and any intervening claims is acknowledged.

Claims 5, 6, 12, 13 and 16 to 18 have been amended as suggested by the Examiner to overcome the 35 U.S.C. §112, second paragraph, rejections to these claims.

Applicant requests that the rewriting of allowable claims 5, 6, 12 and 13 be held in abeyance pending the final determination of the allowability of the respective amended parent claims 1 and 8, respectively.

As to claims 16 to 18, Applicant notes that these amended claims depend directly from allowable independent claim 14 and are therefore now allowable without the need to rewrite now amended claims 16 to 18 to include all of the limitations of allowable, amended base claim 14.

Therefore claims 1 to 18 are submitted to be allowable over the cited references and reconsideration and allowance are respectfully solicited.

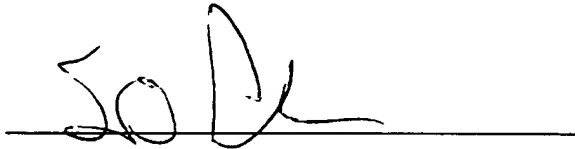
CONCLUSION

In conclusion, reconsideration and withdrawal of the rejections are respectively requested. Allowance of all claims is requested. Issuance of the application is requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned **"Version with markings to show changes made."**

It is requested that the Examiner telephone Stephen G. Stanton, Esq. (#35,690) at (610) 296 – 5194 or the undersigned attorney / George Saile, Esq. (#19,572) at (845) 452 – 5863 if the Examiner has any questions or issues that may be resolved to expedite prosecution and place this Application in condition for Allowance.

Respectively submitted,

A handwritten signature in black ink, appearing to read 'SBA', is written over a horizontal line.

Stephen B. Ackerman

Reg. No. 37,761

Version with markings to show changes made.

In the Specification

Please amend the title of the invention as follows as noted by the
Examiner:

[IMPROVED] CHEMICAL AGENT ADDITIVES IN COPPER CMP SLURRY

Please amend the claims as follows:

4. (Amended) The method of claim 1, wherein said etching agent includes an oxidizer selected from the group consisting of H_2O_2 , KIO_3 , and Fe^{3+} ; an acid or base of HF or $(CH_3)_3N(OH)$; and a buffering agent or organic amine selected from the group consisting of $NH_4(CH_3CO_2)$, alkanol amine, and amino acid.
5. (Amended) The method of claim 1, wherein said carbonyl derivative of benzotriazole comprises from about 0.0001 to 10 weight% of said polishing agent.
6. (Amended) The method of claim 1, wherein said carbonyl derivative of benzotriazole comprises from about 0.01 to 5.00 weight% of said slurry.
7. (Amended) The method of claim 1, wherein said metal is selected from the group [comprising] consisting of Cu, [an] a Cu alloy, Al, and an Al alloy.

8. (Amended) A polishing method comprising the steps of:

forming a film made of material containing a metal as a main component over a substrate having recessed portions on a surface thereof so as to fill said recessed portions with said film; and

5 polishing said film by a chemical mechanical polishing method using a slurry including a polishing agent containing

a chemical agent being responsible for forming a protective film on the surface of said film by reacting with said material containing a metal as a main component, and

10 an etching agent being responsible for etching said material containing a metal as a main component;

thereby forming a conductive film in said recessed portions,

wherein said metal is Cu or a Cu alloy and said chemical agent [includes at least] includes at least a carbonyl derivative of benzotriazole.

11. (Amended) The method of claim 8, wherein said etching agent includes an oxidizer selected from the group consisting of H_2O_2 , KIO_3 , and Fe^{3+} ; an acid or base of HF or $(CH_3)_3N(OH)$; and a buffering agent or organic amine selected from the group consisting of $NH_4(CH_3CO_2)$, alkanol amine, and amino acid.

12. (Amended) The method of claim 8, wherein said carbonyl derivative of benzotriazole comprises from about 0.0001 to 10 weight% of said slurry.

13. (Amended) The method of claim 8, wherein said carbonyl derivative of benzotriazole comprises from about 0.01 to 5.00 weight% of said slurry.

14. (Amended) A polishing method comprising the steps of:

forming a film made of material containing a metal as a main component over a substrate having recessed portions on a surface thereof so as to fill said recessed portions with said film; and

5 polishing said film by a chemical mechanical polishing method using a slurry including a polishing agent containing

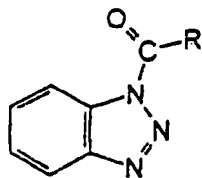
a chemical agent being responsible for forming a protective film on the surface of said film by reacting with said material containing a metal as a main component, and

10 an etching agent being responsible for etching said material containing a metal as a main component;

thereby forming a conductive film in said recessed portions,

wherein said metal is Cu or a Cu alloy and said chemical agent [includes at least] includes at least a carbonyl derivative of benzotriazole having the formula

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20 where R is selected from the group consisting of - CH₃ (methyl), - CH₂CH₃ (ethyl), - CH₂CH₂CH₃ (propyl), - CH₂CH₂CH₂CH₃ (n-butyl), - C(CH₃)₃ (tert-butyl), p-

tolyl, 1 – Benzotriazolyl – 1 – butamido, 2 – pyridyl, 3 – pyridyl, 4 – pyridyl, 2 – thiophenyl, and 3 – thiophenyl.

16. (Amended) The method of claim 14, wherein said etching agent includes an oxidizer selected from the group consisting of H_2O_2 , KIO_3 , and Fe^{3+} ; an acid or base of HF or $(\text{CH}_3)_3\text{N}(\text{OH})$; and a buffering agent or organic amine selected from the group consisting of $\text{NH}_4(\text{CH}_3\text{CO}_2)$, alkanol amine, and amino acid.

17. (Amended) The method of claim 14, wherein said carbonyl derivative of benzotriazole comprises from about 0.0001 to 10 weight% of said slurry.

18. (Amended) The method of claim 14, wherein said carbonyl derivative of benzotriazole comprises from about 0.01 to 5.00 weight% of said slurry.